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# Examining green supply chain management and financial performance: roles of social control and environmental dynamism

**Abstract**—The literature examining the relationship between green supply chain management and firm performance has expanded greatly in recent years. Although researchers maintain that green supply chain management can bring positive financial performance, to date they have ignored the moderating role of the social control mechanism, especially in the context of China. Drawing on social exchange theory, this study aims to contribute to the literature in this field by proposing social control as an effective mechanism to strengthen the impact of green supply chain management on firms' financial performance. Today, most empirical literature in the field of green supply chain management adopts the static view and overlooks the contextual factors. This study addresses the gap by investigating the green supply chain management in an environment characterized by frequently unavoidable disruptions, and the effectiveness of social control that accommodates this complexity and dynamism. By examining green supply chain management under conditions of environmental dynamism, this study contributes to the literature of interface of green supply chain and resilience. Using a sample of 185 Chinese manufacturers, the theoretical model is empirically verified. The research findings indicate that in a dynamic environment, the joint effect of social control and green supply chain management practices is positive and significant. This paper also discusses the theoretical contribution and managerial implications of the study, outlines the research limitations, and provides recommendations for future research.

**Managerial relevance statement**—Based on the empirical results, this research suggests the managers should notice the integrative use of green supply chain management practices and social control mechanism could be an available option in the context of China. Moreover, this study offers the manager a more in-depth statement to explain the relationship between green supply chain management and firm performance by investigating the contingency role of environmental dynamism. This research suggests that when a company's external environment is dynamic, it is necessary for the practitioners to apply social control with both green supply chain practices, i.e. green purchasing, and GCC, to promote their financial performance. However, practitioners should realize that the combination of green supply chain and social control might not be efficient in a stable environment. In this case, if managers cannot correctly assess the external environment factors, they might not get the expected return from investing in such a combination. In particular, our measures of the environmental dynamism could assist managers to evaluate their external environment factors for ensuring the efficiency of implementing the combination of green supply chain management and social control.

**Index Terms** – Green supply chain management (GSCM), social control, environmental management, contingency theory, environmental dynamism

## I. INTRODUCTION

THE issues of climate change, environmental pollution and resource depletion all contribute to increasing global concern over our environment. In December 2015, the Paris Agreement concluded under the United Nations Framework Convention on Climate Change intensified the focus on reducing carbon emissions and now impacts on all manufacturers [1]. Consequently, firms are keen to develop a range of corporate strategies that can effectively reduce environmental impacts and contribute to improving the environmental quality. Moreover, due to increased customer demand for environmentally friendly products, and tighter regulation regarding environmental protection, it has become the norm for manufacturers to adopt related environmental management practices.

Integrating these environmental concerns with the supply chain management, practitioners and academics have paid considerable attention to green supply chain management (GSCM) [2]. Many scholars have examined the association between GSCM and supply chain performance/firm performance, but the results remain inconclusive [3]. Focusing only on the direct effect of GSCM may not provide a complete picture of how GSCM facilitates the financial performance. Chan et al. [4] argue that to understand the effect of environmental management on firm performance, it is necessary to consider a combination of many factors.

To fill the gap, this study integrates the insights from social exchange theory (SET) with the GSCM-performance relationship and examine the extent to which the social control mechanism, viewed as the mechanism by which supply chain partners utilize trust to encourage desirable behaviours [5], impacts on the GSCM-performance relationship. According to the SET, the conduct of a company is not explained solely by economic factors, but also takes account of social factors [6-8]. Given that the social control mechanism is a significant way to manage the supply chain relationship and cooperation in the emerging market [5], it is surprising that very few researchers provide empirical support for its effect on the implementation of GSCM. Hence, whether the social control mechanism and GSCM can jointly affect the financial performance is our first research question.

1 According to Sousa and Voss [9], when there is  
 2 empirical support for the value of best management  
 3 practices, the next step for the researcher is to understand  
 4 under what contextual factors (such as environmental  
 5 dynamism) the management practices are more efficient, or  
 6 even detrimental. For example, when the company is facing  
 7 a highly uncertain environment, some suggested “best  
 8 practice” could negatively impact on the performance.  
 9 According to contingency theory (CT), no theory or  
 10 management practice can work in all instances [10]. Rather,  
 11 the basic assertion of CT is that organizations will adapt  
 12 their structure to “fit” or “match” with their contextual  
 13 factors, such as the environment they operate within, to  
 14 facilitate performance [11]. Further, when investigating the  
 15 implementation of GSCM in an emerging market such as  
 16 China, it is not reasonable to assume that a company’s  
 17 external environment is always stable [4]. However, only a  
 18 small number of GSCM studies have considered the  
 19 contingency role of environmental dynamism, which could  
 20 be a possible contextual factor [4]. Environmental  
 21 dynamism refers to changes in technologies, variations in  
 22 customer preferences, fluctuations in product demand and  
 23 shifts in government policy [12]. In this study, the second  
 24 research question is whether the combination of GSCM and  
 25 social control is still efficient under a dynamic environment.  
 26 Through the lens of CT, the three-way interaction effect of  
 27 GSCM, social control and environmental dynamism on  
 28 firms’ financial performance is examined.

29 To answer the two research questions, a theoretically  
 30 derived model is proposed to explain the relationships  
 31 among the GSCM practices, social control, environmental  
 32 dynamism and financial performance. Given the increasing  
 33 concerns about environmental issues in developing  
 34 countries, there is a strong need for more empirical GSCM  
 35 research in emerging markets, such as China [2]. Thus this  
 36 study tests the model using the cross-sectional data from  
 37 185 Chinese manufacturers with a set of reliable  
 38 measurement scales. Based on the empirical results, this

39 study provides three theoretical contributions. First, the  
 40 environmental management research is advanced by re-  
 41 examining the common assertion that the implementation of  
 42 GSCM could improve the focal firm’s financial  
 43 performance. Although this assertion is widely accepted in  
 44 the literature, empirical results are still inconclusive.  
 45 Second, extending the research that explores the moderators  
 46 between GSCM and performance [4, 13-16], this study  
 47 contributes to the literature by adding social control as a  
 48 moderator of that relationship. Third, using a three-way  
 49 interaction analysis, this study is the first to integrate CT to  
 50 discover under what circumstances social control could be  
 51 helpful or harmful to the relationship between GSCM and  
 52 financial performance.

53 The rest of the paper comprises six sections. Section II  
 54 proposes the research model and develops hypotheses.  
 55 Section III describes the data collection method and  
 56 provides the details of the measurement scales for each  
 57 concept. The data analysis and results are presented in  
 58 Section IV, and discussed further in Section V, which also  
 59 provides the managerial and theoretical implications of the  
 60 study. The limitations to the study and recommendations  
 61 for future research are discussed in Section VI.

62

## 63 II. LITERATURE AND THEORETICAL 64 DEVELOPMENT

65 Drawing GSCM literature, social exchange theory and  
 66 environmental dynamism, a theoretical model is developed  
 67 (Figure 1). Initially, this study hypothesizes that GSCM,  
 68 which includes green purchasing (GP) and green customer  
 69 cooperation (GCC), has a positive impact on the focal  
 70 firm’s financial performance (H1 and H2). Then H3 and H4  
 71 are proposed to explain the positive moderating effect of  
 72 social control on the relationship between GSCM and  
 73 financial performance, i.e. two-way interaction. The last  
 74 two hypotheses (H5 and H6) propose the contingency  
 75 effects of environmental dynamism on the interaction

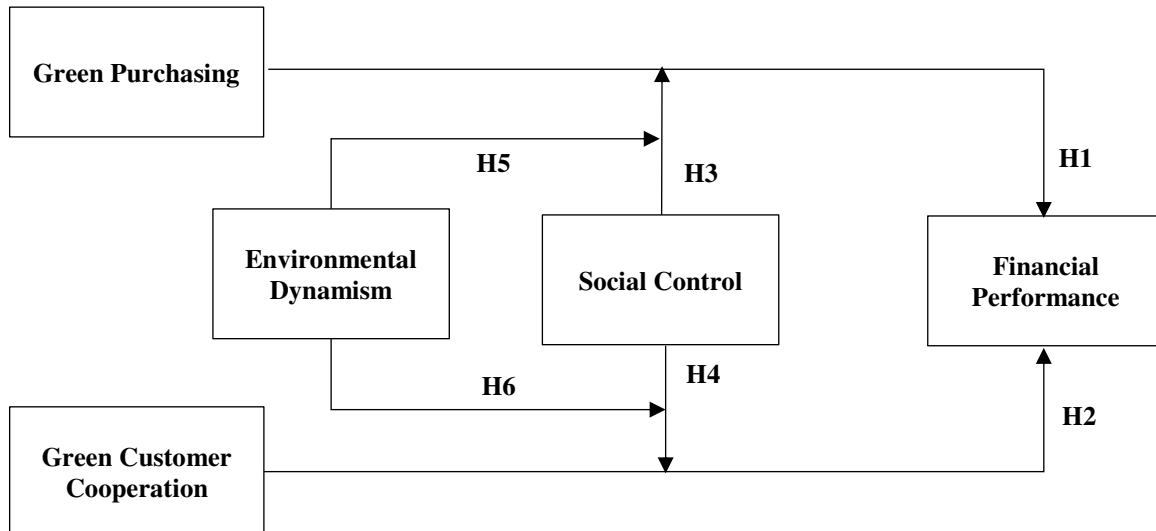


Fig. 1. Hypothesized Model

1 between social control and GSCM, i.e. three-way

### 3 A. Green supply chain management and financial 4 performance

5 Promoting financial performance is an important reason  
6 why a company would seek to implement GSCM practices  
7 [17]. In the South East Asian context, companies with green  
8 supply chain practice have increased competitiveness and  
9 economic performance [18]. According to Rao [19], some  
10 “leading-edge corporations” among South East Asian  
11 companies (such as Nestle Philippines, PT Aryabhatta in  
12 Indonesia, Philip DAP in Singapore, Nestle Jakarta and  
13 Seagate Thailand) have adopted GSCM practices (such as  
14 greening of suppliers’ programs) and received positive  
15 results. Zhu et al. [17] have also verified the relationship  
16 between GSCM and firm performance for Chinese  
17 organizations, and their empirical study provides significant  
18 results. Following existing literature, GSCM is defined as  
19 the external supply chain practices, namely upstream  
20 monitoring (i.e. GP or environmental procurement) and  
21 downstream cooperation (i.e. GCC) [20].

22 GP refers to the management practices whereby the focal  
23 firm assesses suppliers’ environmental performance, while  
24 monitoring the suppliers to check that they take the required  
25 actions to ensure environmental quality [21]. As purchasing  
26 is the starting point of the value chain, a firm cannot  
27 succeed in its environmental efforts until managers  
28 integrate the environmental goal with the purchasing  
29 activities [21]. Rao and Holt [18] consider that GP can help  
30 the company to reduce waste produced by the supplier and  
31 to minimize waste of hazardous materials. In so doing, GP  
32 can promote the firm’s financial performance. For example,  
33 the company can ask suppliers to commit to the waste  
34 reduction goal, for example by minimizing packaging and  
35 using recyclable or reusable packaging, pallets and  
36 containers. Furthermore, in China, violating the  
37 government’s environmental regulations could lead to the  
38 enterprise being shut down. Hence, by implementing GP  
39 that results in preventing suppliers violating environmental  
40 regulations, such as by discharging pollutants in excess of  
41 emission standards, the focal company can reduce its  
42 financial costs or liability.

43 Following Green et al. [22] and Zhu et al. [23], GCC is  
44 defined as “*working with customers to design cleaner*  
45 *production processes that produce environmentally*  
46 *sustainable products with green packaging.*” Drawing upon  
47 the natural resource-based view (NRBV) theory, the  
48 company is encouraged to incorporate the environmental  
49 consideration into their strategic planning, in order to  
50 survive in the marketplace where there is growing  
51 governmental and societal concern over environmental  
52 pollution [24]. The viewpoint of NRBV is in line with the  
53 assertion of Hansmann et al. [25] that success in addressing  
54 the environmental issue may provide more opportunity for  
55 business competition. A firm with better GCC can acquire a  
56 high ecological reputation from customers. Since China  
57 joined the World Trade Organization, more Chinese

2 interaction.

58 manufacturers have sought to become suppliers to  
59 developed country enterprises, which select their suppliers  
60 according to high environmental standards [13]. Therefore,  
61 maintaining a good ecological reputation may help Chinese  
62 manufacturers to win more international opportunities.  
63 Based on a panel of Finnish firms, Laari, et al. [26] found  
64 that an environmental collaborative approach with  
65 customers is key to improving financial performance.

66 Although numerous researches have indicated the  
67 positive effect of GSCM on FP, the debate as to whether  
68 this effect is valid is still ongoing. Some neoclassical  
69 economics researchers hold an opposite view, whereby the  
70 adoption of environmental management practices may  
71 consume more resources and incur additional cost, and thus  
72 result in negative FP [27]. Moreover, the empirical research  
73 results on the relationships between two GSCM practices  
74 (i.e. GP and GCC) and FP are inconclusive. For example,  
75 Green, et al. [22] found that the effect of GCC on economic  
76 performance is insignificant, and Laari, et al. [26] indicate  
77 that the association between GP and financial performance  
78 is not significant. Furthermore, although several studies  
79 have investigated GSCM in the context of China [14], it  
80 should be noted that over the past few years China has  
81 experienced dramatic changes in terms of government  
82 policy and business environment; hence it is necessary to  
83 use a more up-to-date sample to re-examine the concepts.  
84 Therefore, to contribute to filling the gaps in the literature,  
85 we propose the following two hypotheses:

86

87 ***Hypothesis 1: Green Purchasing positively impacts on***  
88 ***financial performance.***

89 ***Hypothesis 2: Green Customer Cooperation positively***  
90 ***impacts on financial performance.***

91

### 92 B. The moderating effect of the social control mechanism

93 This research follows Li et al. [5] to define social control  
94 as “*the mechanism by which supply chain partners utilize*  
95 *trust to encourage desirable behaviors.*” In particular,  
96 social control takes forms such as “*joint problem solving,*  
97 *mutual decision making, information sharing and fulfilment*  
98 *of promises*” [5]. Instead of using formal rules or  
99 agreements to govern business partners, social control  
100 focuses on creating informal pressure to strengthen or  
101 preserve the cooperation [5]. In China, social factors such  
102 as “*repeated exchanges, future obligations and the belief*  
103 *that each party will fulfil its liabilities*” are critical in  
104 business cooperation [6]. According to Li, et al. [5],  
105 Chinese managers tend to adopt social control in interfirm  
106 cooperation. Using a survey of managing Chinese supplier  
107 relationships, Giannakis et al. [28] stress the importance of  
108 the social control of governance structure. Moreover, Li et  
109 al. [5] find that social control is a substantial factor that  
110 contributes to the cooperation performance in China’s  
111 buyer-supplier relationship.

The concept of social control is highly relevant to the context of SET. Social exchange, which is the focus of SET, can be defined as “voluntary actions of exchange parties that are motivated by the returns they are expected to obtain” [7, 29]. According to Larson [30], SET suggests that the collaborative initiatives in the inter-organizational relationship are not solely governed by the formal mechanism. SET can shed light on the social components governing exchange relationships, which include the “give-and-take” between entities, reciprocity and cooperation [31]. Furthermore, from the perspective of SET, the exchange parties follow the rules of reciprocity voluntarily, because they wish to avoid punishment in social relationships [7]. According to Tachizawa and Wong [32], the GSCM practices can represent different social exchanges in a supply chain relationship due to the interaction between focal company and supplier or between focal company and customer. Therefore, SET should give important insights into the role of social control in the relationship between GSCM and FP, because the use of social control, focusing on interfirm trust, joint problem solving and shared norms, can provide the foundation for the successful implementation of GSCM practices so as to foster FP.

The argument that social control plays a positive moderating role is supported by SET. From the perspective of SET, commercial companies interact with each other for a reward or with the expectation of a reward for their cooperation with others [8]. The business transactions along the supply chain governed by a strong social control can be said to provide more stability and predictability for the interfirm cooperation, due to the reliance on shared norms and trust [31]. Suppliers in the environmental cooperation activities can thus expect that the focal company will reciprocate different benefits in the future. This expectation is based on two SET assumptions, namely that actors behave rationally and that gratification is dependent on others [31]. SET suggests that with the expectation of a reward, exchange parties will regularly discharge their obligations and make efforts to strengthen their reputation to show the business parties their commitment to the relationship [29]. This may be especially applicable to cost reduction in the activities of GP with the use of social control. Due to the strong social ties and predictable reciprocity, suppliers should offer better service or more cost-effective solutions for the green cooperation with their focal company, and thus contribute to better FP of the focal company. For example, information transparency is always a challenge for the focal company when conducting the environmental audit for the second-tier supplier [33]. With greater social control, the company should find it easier to get the expected information, because the first-tier supplier may be more willing to share the environmental information from their suppliers (i.e. second-tier). This is because, when social control is high, they wish to maintain and strengthen the relationship with the focal company. In addition, Sarkis [34] highlights that one of the difficulties in GP as an interfirm cooperation

practice is that there are conflicting goals between the buyer and supplier. According to Li et al. [35], social control emphasizes the mutual benefits and common norms. In such a case, social control might help to overcome the barrier of goal conflict to interact with GP and contribute to better financial performance. Thus, the following hypothesis is proposed:

**Hypothesis 3:** *The positive effect of green purchasing on financial performance is positively moderated by social control.*

Few researches have explicitly examined the moderating effect of social control on the positive effect of GCC on financial performance. However, there is recent empirical evidence that if the company needs to improve financial performance through green innovation, enhancing reciprocity and cooperation with the customer is necessary, which is also well supported by SET [15]. The assumption that the effectiveness of GCC increases when social control is high is reasonable. The activities of GSCM require multiple social resources and are costly [36]. According to Zhu et al. [14], Chinese companies recognize the critical nature of their environmental mission, due to the incentive of attracting more business opportunities from the downstream supply chain. If the focal companies are unable to ensure that they will receive the benefits from the greening activities with their customers, it will be difficult to bring about significant improvements in financial performance. A basic SET assumption is that building social “credit” is preferred to social “indebtedness” [37]. In the Chinese context, the focal firm’s efforts towards green cooperation with customers can be seen as a form of favor offered to the client. As argued by Kaufmann and Carter [38], the social control mechanism can help to form the informal pressure in the buyer-supplier relationship to sustain the supply chain cooperation. Drawing upon the SET, we argue that with greater SC, the benefits the customer company receives from the GCC activities, which can be seen as a favor [39], should place more informal pressure on the customer to offer more business opportunities or other financial benefits. Therefore, this study proposes the following moderation hypothesis:

**Hypothesis 4:** *The positive effect of green customer cooperation on financial performance is positively moderated by social control.*

#### C. The contingency effect of environmental dynamism

The highly dynamic environment is characterized by great speed and change [40] and by less clarity of information [41]. Jansen et al. [42] define environmental dynamism as “change in technologies, variations in customer preferences, and fluctuations in product demand or supply of materials.” Here, this study sets the scope of the concept by specifying that the uncertainties arise from

1 the external environment of the focal company. Within the  
 2 supply chain context, a number of arguments have been put  
 3 forward to stress that environmental uncertainty is an  
 4 unavoidable contextual factor, because the flow of  
 5 materials and information exchange involves complex  
 6 communication and multiple lines of tasks across chain  
 7 members [11, 43]. This highly uncertain environment  
 8 provides challenging tasks for the company to tackle, and  
 9 as Khandwalla [44] points out, the higher the market  
 10 dynamism, the lower the ability of managers to predict the  
 11 future of their companies. However, there might be an  
 12 interesting twist to environmental dynamism. In the context  
 13 of China, Li and Liu [45] find empirical evidence that  
 14 companies are provided with greater dynamic capability to  
 15 sustain their competitive advantages when environmental  
 16 dynamism is high. Likewise, based on an empirical  
 17 research in China, Jiao et al. [46] suggest that  
 18 environmental dynamism enables companies to achieve  
 19 better opportunity-sensing capability and hence better  
 20 business performance. This study posits that the moderating  
 21 effect of the social control mechanism on the GSCM-  
 22 performance relationship will be strengthened in a dynamic  
 23 environment, i.e. high environmental dynamism.

24 To explain the three-way interaction effect (i.e.  
 25 moderated moderation), this study applies the CT.  
 26 According to the CT, a contingency paradigm includes  
 27 three kinds of variables, namely *contextual variables*,  
 28 *response variables* and *performance variables* [9].  
 29 Environmental dynamism can be viewed as a *contextual*  
 30 *variable* [4], which is hard for companies to control or  
 31 manipulate. Drawing from our proposed model, this study  
 32 views the *interactive effect* of GSCM and social control as a  
 33 form of *response factor* in the contingency paradigm. In  
 34 line with the CT, environmental dynamism is not treated as  
 35 an activator or a motivator. Theoretically, this research  
 36 focuses on the impact of environmental dynamism on the  
 37 strength of the relationship between the GSCM-social  
 38 control interactive effect and FP (i.e. dependent variable)  
 39 [11].

40 From the perspective of CT, when companies are facing  
 41 uncertainty in the external environment, they usually  
 42 respond through a series of externally oriented strategies  
 43 [11, 47]. In line with the CT, this study argues that the  
 44 interactive effect of social control and GP should “fit” with  
 45 a highly dynamic environment. According to Stonebraker  
 46 and Liao [48] and Koufteros, et al. [49], a highly dynamic  
 47 market requires companies to acquire and process  
 48 additional and rich information. Thus, the information  
 49 asymmetry that arises in the activities of GP might be more  
 50 significant. Sitkin et al. [50] argue that under a highly  
 51 dynamic market, a company needs to facilitate flexible  
 52 response and quick decision-making. As a motivator of the  
 53 effect of GP on FP, the social control mechanism, which  
 54 can further enhance the flexibility in the supply chain,  
 55 should be more efficient in an unstable market. In contrast,  
 56 a stable environment can provide manufacturers with more  
 57 predictability, and enables manufacturers more easily to

58 anticipate, prepare for and respond to change [51]. As  
 59 suggested by Anand and Ward [52], organizations in a  
 60 stable environment should develop routines to handle the  
 61 possible scenarios. Therefore, when a company faces a  
 62 relatively stable environment, social control may not be  
 63 necessary, as a manufacturer can rely on existing policies  
 64 and regulations to perform environmental compliance audit  
 65 toward its suppliers.

66

67 ***Hypothesis 5: The interaction effect of social control and***  
 68 ***green purchasing is more highly and positively associated***  
 69 ***with financial performance in a more dynamic environment.***  
 70

71 CT theorists argue that to foster organizational  
 72 performance, selecting an appropriate organizational  
 73 structure to “fit” the external environment is critical [53,  
 74 54]. According to Thompson [55], the effects of firms’  
 75 actions are partially determined by the “*actions of elements*  
 76 *of the environment*”. Therefore, from the perspective of CT,  
 77 Germain, et al. [53] suggest that, “*a firm must determine*  
 78 *when and how to act, and its cues must be taken primarily*  
 79 *from the environment*” (p. 561). In a dynamic environment,  
 80 the market is unstable due to rapid changes in product  
 81 demand, customer preference and technology innovation  
 82 [4]. In such an environment, there is a greater likelihood  
 83 that opportunism will arise in the buyer-supplier  
 84 relationship [56, 57]. For example, government policies  
 85 providing incentives for companies to engage in  
 86 environmental activities could change in a dynamic  
 87 environment. This situation may encourage opportunism on  
 88 the part of the customer company, manifested in behavior  
 89 such as occupying all the benefits or reward from the  
 90 government without sharing these benefits with the focal  
 91 company. However, with greater social control, the  
 92 customer company might be more willing to share the  
 93 reward or even share the risk with the focal company, given  
 94 that goal concurrence and mutual benefit are critical  
 95 elements of social control [5]. Unlike a dynamic  
 96 environment, a stable environment can hinder the  
 97 opportunism that arises in business relationships [58].  
 98 Accordingly, if opportunism is not a major threat between  
 99 partners, the use of social control will hardly be economical.  
 100 Hence, the moderating effect of social control should be  
 101 less positive in a stable environment. Also, Chan, et al. [16]  
 102 argue that a highly competitive market should strengthen  
 103 the adoption of GCC, as the focal company needs to make  
 104 more effort to satisfy the customer's increasing  
 105 environmental demands. Extending this finding, this  
 106 research assumes that the use of social control, which  
 107 emphasizes information exchange and joint problem  
 108 solving [5], enables the company to understand and respond  
 109 to their customers more efficiently under a highly dynamic  
 110 market. Hence, complementing Hypothesis 4 with the  
 111 contextual variable, the following hypothesis of three-way  
 112 interactions is proposed:

113

1 **Hypothesis 6:** The interaction effect of social control and  
2 green customer cooperation is more highly and positively  
3 associated with financial performance in a more dynamic  
4 environment.

### III. METHOD

#### A. Data Collection

TABLE I  
DEMOGRAPHIC INFORMATION

	Number of firms	Percentages (%)
<b>Industry Sector</b>		
Electronic and other electrical equipment and components, except for computer equipment	110	59.5
Pharmaceutical industry	4	2.2
Automotive industry	39	21.1
Other	32	17.3
<b>Firm Size</b>		
100-299	57	30.8
300-2000	112	60.6
>2000	16	8.6
<b>Region</b>		
Pearl River Delta	87	47
Yangtze River Delta	68	36.8
Circum-Bohai-Sea Region	30	16.2

#### B. Measures

38 Based on a thorough review of the key literature in the  
39 field of Operations Management (OM), where most of the  
40 GSCM research appears, we first selected the appropriate  
41 measurement instruments that matched with our proposed  
42 constructs. The English version of the measurement scale  
43 was developed by the authors and then translated into  
44 Chinese by an experienced OM expert in China. Informed  
45 by comments from a semi-structured interview with our  
46 expert panel<sup>1</sup>, we modified the original items and created  
47 some new ones. Then the refined Chinese version was  
48 translated back into English by the expert to ensure  
49 accuracy. The measurement items were all measured  
50 according to a seven-point Likert scale. The constructs in  
51 theoretical model were measured by the mean value of their  
52 corresponding items.

53

#### 54 1) Dependent Variable: Financial Performance (of the 55 focal company)

56 In line with the key OM empirical literature (e.g., [62,  
57 63]), we measure the financial performance of the focal  
58 company by five indicators: return on asset, growth of sales,  
59 return on investment, growth in return on investment and  
60 profit margin on sales. The respondents were asked to  
61 compare their company performance regarding these  
62 indicators over the last three years (i.e. 2013 - 2015). The 7-  
63 point Likert scale for financial performance ranges from 1,  
64 for “decreased significantly” to 7, for “increased  
65 significantly.” Because most of the respondents do not  
66 represent listed companies, the audited financial data is not  
67 available to us. Therefore, using the perception scale is a  
68 more reasonable option for our investigation. Moreover, the  
69 measures for financial performance have been widely  
70 adopted in previous studies and the construct reliability of  
71 the measures is confirmed with Cronbach’s alpha = 0.855.  
72 In summary, the indicators of financial performance  
73 adopted in this study are reliable.

74

#### 75 2) Independent Variable: Green Purchasing and Green 76 Customer Cooperation

77 The measures for both GP and GCC were adopted from  
78 the existing literature [14, 64], and have been used in many  
79 other recent OM studies across different country contexts  
80 (such as [22], [16]). Moreover, because this study focuses  
81 on Chinese manufacturers, Zhu et al.’s [14, 23, 64] green  
82 practice measures for Chinese manufacturers should be  
83 applicable in our study. Although the measures of green  
84 practices from existing studies are well developed and  
85 widely accepted, we modified and updated some contents  
86 based on the pilot research and comprehensive literature  
87 review. For example, this study obtained one item in GP  
88 (denoted as GP1) from the IBM Environmental Report [65];  
89 this concerns preventing upstream suppliers from  
90 transferring the responsibility for environmentally sensitive

<sup>1</sup> The expert panel comprised three academics and three top managers. They are all from China and have expertise in the manufacturing industry.

1 operations to other unqualified companies. Regarding  
2 customer cooperation, our expert panel members reflected  
3 that the description of the item - “*cooperation with*  
4 *customers for using less energy during product*  
5 *transportation*” was vague. Therefore, based on the experts’  
6 comment, this study modified the description to –  
7 “*cooperation with customers for maximizing the use of*  
8 *logistics resources (e.g. good planning in product*  
9 *transportation route plan)*.” The level of adoption of the  
10 green practice is assessed by a seven-point Likert scale with  
11 descriptors from 1, for “strongly disagree” to 7, for  
12 “strongly agree.” The values of Cronbach’s alpha are 0.855  
13 and 0.826 for GP and customer cooperation respectively.  
14 Hence, the constructs are reliable, as they exceed the  
15 recommended value of 0.7.

16

### 17 3) Contextual Factor and Moderator: Environmental 18 Dynamism and Social Control Mechanism

19 The scales for measuring the environmental dynamism  
20 were adopted from the previous literature [4]. The  
21 indicators of the item pool reflect the dynamism of the  
22 external environment in the following aspects: degree of  
23 market uncertainty, evolving technologies, end-consumer  
24 demand uncertainty and frequent changes in government  
25 environmental regulations. Items are assessed by  
26 respondents’ perceived level of agreement, ranging from 1,  
27 for “strongly disagree” to 7, for “strongly agree.” The  
28 construct is reliable, as its Cronbach’s alpha exceeds 0.7, at  
29 0.866.

30 Regarding the social control mechanism toward the  
31 supply chain members (i.e. upstream suppliers and  
32 downstream industrial customers), this study uses the scale  
33 from Li, et al. [5]. The respondents were asked to indicate  
34 whether their supply chain relationship is controlled  
35 through: a. reliance on the supply chain partners to keep  
36 promises; b. joint problem-solving with supply chain  
37 members; c. participatory decision-making, or d. fine-  
38 grained information exchange. As in the case of the green  
39 practices constructs, the scale ranged from 1, for “strongly  
40 disagree” to 7, for “strongly agree.” As shown by the  
41 Cronbach’s alpha = 0.831, this construct was also reliable.

42

### 43 4) Control Variables

44 This study also adopts four control variables that might  
45 have impacts on the firm’s financial performance, namely  
46 firm size, industry sector and geographic location. Most

47 existing OM researches consider firm size as a control  
48 variable on the financial performance. According to Zhao et  
49 al. [66], larger firms may have more resources to engage in  
50 supply chain activities so as to enhance performance. Also,  
51 the firm size might represent the company’s ability to  
52 leverage resources to manage external uncertainties.  
53 Following Zhu and Sarkis [13], this study measures firm  
54 size by the number of full-time employees according to a  
55 three-point scale (“1” represents fewer than 300 employees;  
56 “2” more than 300 but fewer than 2000 employees, and “3”  
57 more than 2000 employees). Regarding industry sector, we  
58 code electronic and other electrical equipment and  
59 components, except for computer equipment, as “1”, the  
60 pharmaceutical industry as “2”, and the automobile industry  
61 as “3” and other industry as “4.” The study also controls for  
62 the geographic locations of respondents. We collected the  
63 data from three major economic zones in China, namely  
64 Pearl River Delta (labelled as “1”), Yangtze River Delta  
65 (labelled as “2”) and Circum-Bohai-Sea Region (labelled as  
66 “3”).

67

68

## IV. DATA ANALYSIS AND RESULTS

### 69 A. Assessing Reliability and Validity of Indicators

70 Because this study uses multiple items to measure each  
71 construct, a rigorous process was conducted to assess the  
72 construct reliability, uni-dimensionality, discriminant  
73 validity and convergent validity. The Cronbach’s alpha of  
74 our constructs all exceeded the benchmark value of 0.7,  
75 thus providing initial confirmation of the construct  
76 reliability. To further assess the construct reliability, the  
77 corrected item-total correlations (CITC) were checked. As  
78 shown in the Appendix A, all the CITC values were greater  
79 than 0.453 and exceeded the recommended value of 0.30  
80 [67].

81 In order to assess the uni-dimensionality of the indicators,  
82 we used two widely accepted methods, namely exploratory  
83 factor analysis (EFA) and confirmatory factor analysis  
84 (CFA) [68]. For EFA, principal component analysis with  
85 Varimax rotation was observed to initiate the factor  
86 structure. EFA confirmed the measures of adequacy of  
87 sampling, because the Kaiser-Meyer-Olkin (KMO) was  
88 greater than 0.5, at 0.834, and the Bartlett’s test of  
89 sphericity was significant at 0.001 level with  $X^2 = 2027.482$   
90 and degree of freedom ( $df$ ) = 210. Hence, the data were

TABLE II  
DISCRIMINANT VALIDITY

Variable	1	2	3	4	5
1. Green Customer Cooperation	<b>0.744</b>	197.116	259.187	84.656	189.263
2. Financial Performance	0.398	<b>0.733</b>	525.159	248.496	84.254
3. Environmental Dynamism	0.143	0.090	<b>0.850</b>	316.112	264.889
4. Green Purchasing	0.705	0.375	0.054	<b>0.782</b>	241.615
5. Social Control	0.424	0.697	0.106	0.258	<b>0.752</b>

a. The value in bold in the diagonal of the table is the square root of AVE. b. The lower triangle shows the correlation. c. The upper triangle shows the  $X^2$  difference between the pairwise factor model and single factor model. All  $X^2$  difference test with 1-degree freedom, so if  $X^2 > 11$ , the p-value is significant at 0.001 level.



1 suitable to proceed with factor analysis. This study obtained  
 2 five factors with eigenvalues greater than one, explaining  
 3 68.34% of the total variance. The indicators were strongly  
 4 linked to our proposed latent variable, where the size of the  
 5 factor loadings were all higher than 0.652. Moreover, there  
 6 was no significant cross loading (the difference between  
 7 respective factor loadings less than 0.10), which also  
 8 indicates that the “*items were unidimensional with regard*  
 9 *to our proposed constructs*” [68]. Also, to further confirm  
 10 the uni-dimensionality, the overall model fit indices of the  
 11 measurement model (i.e. CFA) were assessed, such as  
 12 comparative fit index (CFI), non-normed fit index (NNFI),  
 13 root mean square error of approximation (RMSEA) and  
 14 normed chi-square ( $X^2/df$ ). In the measurement model, this  
 15 research established links between the indicators and  
 16 respective constructs then freely estimated the covariance  
 17 among all five constructs. Using SPSS AMOS 23, we found  
 18 that the model fit indices indicated that the measurement  
 19 model was a good fit (CFI = 0.977; NNFI = 0.972; RMSEA  
 20 = 0.037;  $X^2/df$  = 1.250) [69]. In summary, both EFA and  
 21 CFA demonstrated good uni-dimensionality of our  
 22 measurement items.

23 Regarding the convergent validity, this study assessed  
 24 the significance of the indicators with their corresponding  
 25 constructs by *t-value* and average extracted variance (AVE).  
 26 All *t-values* of the factor loadings in the measurement  
 27 model were greater than the benchmark value of 2.0,  
 28 ranging from 8.429 to 14.645 [69]. Additionally, the AVE  
 29 values ranged from 0.538 to 0.723, thus exceeding the  
 30 recommended value of 0.5. These results indicate the  
 31 convergent validity. The discriminant validity was tested by  
 32 comparing the square root of AVE for each construct with  
 33 the inter-construct correlations. Chin [70] suggests that the  
 34 square root of AVE should be greater than the inter-  
 35 construct correlations. As shown in Table 2, the  
 36 measurement model meets the criterion of discriminant  
 37 validity. Furthermore, this research built CFA models for  
 38 every possible paired latent variable. Then,  $X^2$  difference  
 39 test was used to compare the paired model with the result of  
 40 the one-factor model [23]. As shown in the upper triangle  
 41 of Table 2, the differences in the  $X^2$  test of paired CFA  
 42 models were all significant at 0.01 level, suggesting that the  
 43 measurement model satisfies discriminant validity.

44

#### 45 B. Common Method Bias and Endogeneity

46 Owing to the fact that data were collected from a single  
 47 respondent per firm, and were perceptual, common method  
 48 bias might be a concern for this study. To check for the  
 49 common method bias, three different tests were conducted.  
 50 First, Harman’s one-factor test was used [71]. There were  
 51 five factors with eigenvalues exceeding 1.0, accounting for  
 52 68.34% of the total variance. Among these the first factor  
 53 accounted for 30.06%, which is not the majority of the total  
 54 variance [62]. Secondly, this study used CFA to further  
 55 perform Harman’s single factor test. We established a  
 56 single factor model linking all the indicators. This single

57 factor model was unfit (CFI = 0.428; NNFI = 0.364;  
 58 RMSEA = 0.117;  $X^2/df$  = 6.774), and its results were much  
 59 worse than the results of the measurement model, indicating  
 60 that a single factor model was not acceptable, and the  
 61 likelihood of common method bias was small [62, 63]. To  
 62 reinforce the results of Harman’s one-factor test, this  
 63 research operated an additional test following Paulraj et al.  
 64 [72] and Widaman [73]. Two CFA models were tested, of  
 65 which one had only the traits and one added a method  
 66 factor in addition to the traits [62, 72]. The factor loadings  
 67 were not much different between the two models and the *t*-  
 68 values remained significant despite the inclusion of the  
 69 method factor. Moreover, the method factor accounted for  
 70 16.81% of the common variance and marginally improved  
 71 the model fit [CFI by 0.04, NNFI by 0.05 and RMSEA by -  
 72 0.004].

73 Finally, this study applied the “Marker-Variable” method  
 74 as an alternative approach to further assess the potential  
 75 common method bias [74]. The research adopted the  
 76 recommended procedures and formulas provided by  
 77 Malhotra, et al. [75]. First, firm’s supply chain position [76]  
 78 was chosen as a marker variable (i.e. a variable that is  
 79 theoretically unrelated to at least one variable in the model).  
 80 As shown in Appendix B, the correlations between the  
 81 marker variable and other constructs were small and  
 82 insignificant at  $p < 0.05$ . Then, this study used the lowest  
 83 positive correlation between marker variable and other  
 84 variables ( $r_a = 0.024$ ) to compute the adjusted correlation  
 85 [75]. The results indicated that none of the significant  
 86 correlations in zero-order correlations became insignificant  
 87 after the adjustment (See Appendix B). In summary,  
 88 common method bias is unlikely to be a threat to this study.

89 Antonakis, et al. [77] argue that common method bias  
 90 and simultaneity (reverse causality) are two of the major  
 91 concerns in endogeneity. As verified in the previous section,  
 92 common method bias was not a critical issue in this study.  
 93 Regarding simultaneity, the problem exists when dependent  
 94 variable and independent variable simultaneously impact on  
 95 each other and have reciprocal feedback loops [78]. There  
 96 is a substantial body of theoretical literature and logical  
 97 arguments reflecting that the GSCM practices are linked  
 98 with FP [14, 22]. Moreover, by reviewing 50 GSCM  
 99 empirical studies in the emerging markets, and carrying out  
 100 a rigorous meta-analysis, the positive effects of GP and  
 101 GCC on FP were further confirmed [79]. Hence,  
 102 simultaneity (reverse causality) is unlikely to be a problem  
 103 in this context. This study also empirically tested whether  
 104 endogeneity was a potential issue in the relationship  
 105 between GSCM and FP. The Durbin-Wu-Hausman (DWH)  
 106 test (i.e. augmented regression test) was performed to  
 107 examine whether the GP and GCC were endogenous to the  
 108 model [80]. Following Dong, et al. [81], this research first  
 109 regressed GP and GCC on all controls respectively to  
 110 obtain the residuals of each regression. Then, two  
 111 augmented regressions were performed by using the  
 112 residuals as additional independent variables. The results  
 113 showed that the parameters estimated for the residual ( $\beta_r$ ) in

TABLE III.  
HIERARCHICAL REGRESSION RESULTS

Variables	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 5b
<b>Controls</b>						
Industry Sector	0.037	0.028	0.019	0.027	0.027	0.024
Region	-0.030	-0.042	-0.022	-0.021	-0.011	-0.013
Firm Size	0.063	0.085	0.015	0.007	0.000	0.001
<b>Main Effects</b>						
Green Purchasing ( <b>H1</b> )		0.186*	0.141†	0.151†	0.142†	0.159*
Green Customer Cooperation ( <b>H2</b> )		0.235**	0.080	0.101	0.101	0.095
Social Control			0.537**	0.532**	0.514**	0.504**
Environmental Dynamism				-0.036	-0.004	-0.025
<b>Two-way interactions</b>						
Green Purchasing × Social Control ( <b>H3</b> )			0.236*	0.238*	0.262*	0.236*
Green Customer Cooperation × Social Control ( <b>H4</b> )			-0.183	-0.165	-0.063	-0.034
Green Purchasing × Environmental Dynamism				-0.038	-0.086	-0.023
Green Customer Cooperation × Environmental Dynamism				0.101	0.143†	0.123†
Social Control × Environmental Dynamism				-0.080	-0.077	-0.080
<b>Three-way interaction</b>						
Green Purchasing × Social Control × Environmental Dynamism ( <b>H5</b> )					0.190*	
Green Customer Cooperation × Social Control × Environmental Dynamism ( <b>H6</b> )						0.197*
$\Delta R^2$ (Financial Performance)		0.142	0.249	0.009	0.015	0.013
$R^2$ (Financial Performance)	0.008	0.386	0.631	0.638	0.649	0.648
<i>F Change</i>		14.886**	24.261**	0.636	4.371*	3.972*

Note: †  $p < 0.1$  \*  $p < 0.05$  \*\*  $p < 0.01$

1 augmented regression were not significantly different from  
2 zero (for GCC:  $\beta_r$  was insignificant as  $p = 0.6176$ ; for GP:  
3  $\beta_r$  was insignificant as  $p = 0.0721$ ). This indicates that both  
4 GP and GC were not endogenous [81].

5

## 6 B. Results

7 A multiple-step hierarchical regression model was  
8 established to test the hypotheses. In the regression model,  
9 this study first introduced three control variables in Model 1.  
10 Then the main effects of GP and GCC on financial  
11 performance (i.e. H1 and H2) were examined in Model 2.  
12 H3 and H4 were tested in Model 3. Following and Liu  
13 [82], Model 4 was built as a basis for the comparison  
14 among models to obtain the significance of the change of  
15  $R^2$  and  $F$  hierarchical value. The three-way interaction  
16 among GSCM practices, environmental dynamism and  
17 social control were tested in Model 5a and Model 5b. As  
18 suggested by previous studies, in order to minimize the  
19 threat of multi-collinearity, each variable in our model was  
20 mean-centered before calculating all the interaction  
21 products [82]. Also, this study used variance inflation factor  
22 (VIF) and tolerance value to assess the potential multi-  
23 collinearity issue. The VIF values of our results are all

24 below the threshold of 10 and the lowest tolerance value is  
25 greater than the benchmarking value of 0.1 [69]. Therefore,  
26 multi-collinearity is not a significant threat to our  
27 regression analysis. The results with standardized path  
28 coefficients,  $R^2$  and  $F$  value are reported in Table 3.

29 In Model 1, no significant relationships between the  
30 control variables and financial performance were found.  
31 The model explains only 0.08 percent of the variance. Then,  
32 the control variables and two main effects variables were  
33 added into Model 2. GP ( $b = 0.186$ ,  $p < 0.05$ ) and GCC ( $b$   
34  $= 0.235$ ,  $p < 0.01$ ) both positively impact on financial  
35 performance, indicating that Hypothesis 1 and Hypothesis 2  
36 are both supported. Model 2 also makes a significant  
37 contribution over and above Model 1 ( $F$  hierarchical value  
38  $= 14.886$ ,  $p < 0.001$ ). Model 3, which tests the interaction  
39 between the GSCM practices and social control mechanism,  
40 makes a significant contribution over Model 2 ( $F$   
41 hierarchical value  $= 24.261$ ,  $p < 0.001$ ). The interaction  
42 between GP and social control mechanism has a positive  
43 and significant coefficient ( $b = 0.236$ ,  $p < 0.05$ ) on the  
44 financial performance. However, the moderating effect of  
45 social control on the relationship between GCC and  
46 financial performance is not significant ( $b = -0.183$ , n.s.).

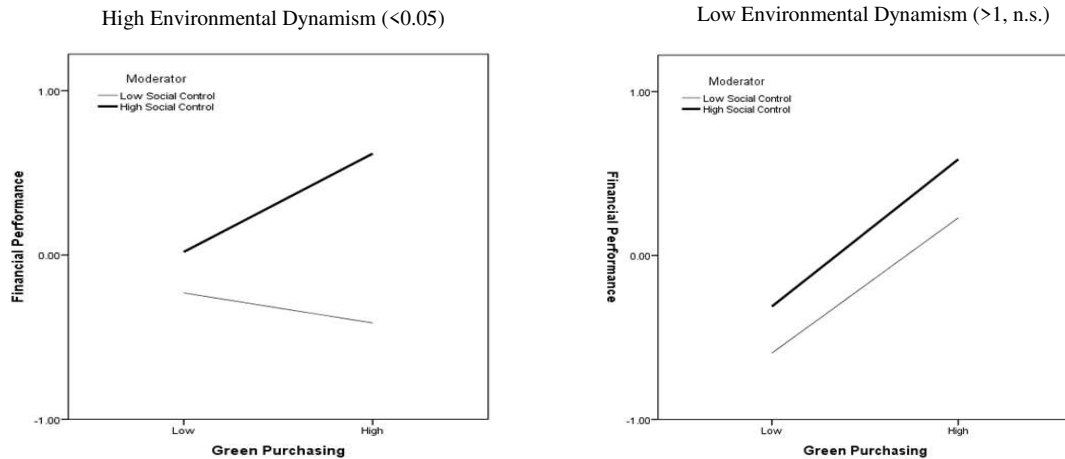


Fig. 2. Three-way interaction: Green Purchasing, Social Control and Environmental Dynamism

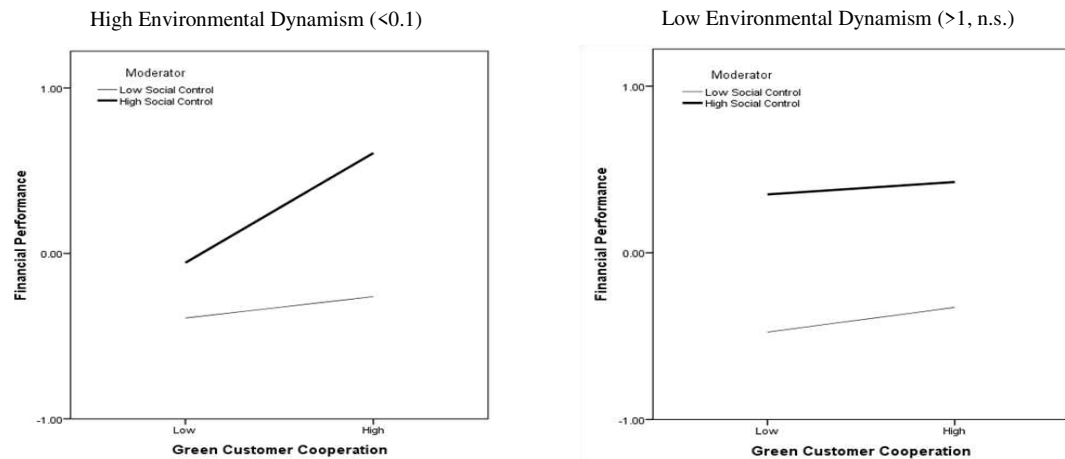


Fig. 3. Three-way interaction: Green Customer Cooperation, Social Control and Environmental Dynamism

1 Thus, Hypothesis 3 is supported, while Hypothesis 4 is not  
 2 supported. Following Aiken and West [83], a simple slope  
 3 test was performed to further confirm the moderating  
 4 effects. The moderator was assigned the value of one  
 5 standard deviation above and below its mean to indicate  
 6 two levels of social control. According to the simple slope  
 7 analysis, GP was more efficient when the company has  
 8 higher social control. Specifically, the path coefficient of  
 9 GP was highly significant under high social control ( $b =$   
 10  $0.2426, p < 0.05$ ), while it was not significant under low  
 11 social control ( $b = 0.0545, n.s.$ ).

12 Finally, in Models 5a and 5b, this study found significant  
 13 and positive three-way interaction among GSCM practices,  
 14 social control and environmental dynamism (GP:  $b = 0.190,$   
 15  $p < 0.05$ ; GCC:  $b = 0.197, p < 0.05$ ). Also, the three-way  
 16 interaction models (i.e. 5a and 5b) made a significant  
 17 contribution over Model 4 in that the  $F$  hierarchal values  
 18 were all significant at 0.05 level. Once again, this study  
 19 used a simple slope test to check the three-way interactions.  
 20 The conditional effect of the interaction between social  
 21 control and GP was highly significant at high level of  
 22 environmental dynamism ( $t = 2.5258, p < 0.05$ ), while it

23 was insignificant at low level of environmental dynamism  
 24 ( $t = 0.3804, n.s.$ ), supporting Hypothesis 5. However, we  
 25 found only a marginally significant interaction between  
 26 social control and GCC at high level of environmental  
 27 dynamism ( $t = 1.8125, p < 0.1$ ). The two-way interaction is  
 28 also insignificant at low level of environmental dynamism  
 29 ( $t = -0.5138, n.s.$ ), which is similar to the result for GP.  
 30 Therefore, this study conclude that Hypothesis 6 is also  
 31 supported. Graphs for the three-way interactions appear in  
 32 Figure 2 and Figure 3.

33 Further, due to the relatively small sample size, Gpower  
 34 v3.1 software was used to conduct power analysis as a  
 35 robustness check to identify the required sample size for the  
 36 hierarchical regression model. Following Engelen, et al.  
 37 [84], this study conducted a post hoc statistical test for  
 38 given alpha value, sample size and effect size. To explain  
 39 the effect size of 0.2 [84], with an alpha of 0.5 and sample  
 40 size of 185, an ideal statistical power of 99% from our most  
 41 complex models (Model 5a and 5b) was received, which  
 42 include thirteen predictors. This implies that the regression  
 43 model has less than 1% probability of a non-significant  
 44 finding that is actually significant [84]. Therefore, it can be

1 concluded that the sample size of this research has  
2 sufficient power to explain the models.

3

4

## V. DISCUSSION

5 The significant and positive results for the main effects  
6 of GSCM (i.e. H1 and H2) on financial performance are in  
7 line with our expectation and support the findings of prior  
8 research examining the relationship between GSCM and  
9 firm performance [13-15]. Although the potential value of  
10 implementing GSCM in the context of the emerging  
11 markets has been widely recognized by both academics and  
12 practitioners, this study further justifies the economic value  
13 of GSCM in the manufacturing industry. Specifically, this  
14 research finds that GP could bring firms better financial  
15 performance, which is consistent with Vachon and  
16 Kalessen and Rao and Holt [18]. Supporting the notion of  
17 Laari et al. [26], our result also shows that firms' financial  
18 performance is significantly and positively associated with  
19 GCC. The above findings indicate that it is important to  
20 implement GSCM in the form of upstream monitoring and  
21 downstream cooperation in order to achieve greater  
22 financial performance. Moreover, this study shows that the  
23 effect of GCC on financial performance is greater than that  
24 of GP, which indicates that GCC might be a more  
25 significant driver of firms' financial performance. This  
26 finding is consistent with Zhu et al.'s [17] assertion that  
27 GCC is an efficient factor within the GSCM practices to  
28 improve a company's economic performance.

29 Further, considering the characteristics of the business  
30 environment in China, this study examines the moderating  
31 role of social control in the relationship between GSCM  
32 and financial performance. This proposition is in line with  
33 the SET that the economic transaction focuses not only on  
34 the economic factor, but also on the social factor. The result  
35 of multiple regression analysis shows that the moderating  
36 effect of social control on the relationship between GP and  
37 financial performance is positive and significant. This  
38 suggests that when the company is implementing activities  
39 of GP, strengthening social control over their chain  
40 members is helpful to maximize the economic outcome of  
41 that GP. A possible explanation is that Chinese companies  
42 normally do not have advanced information systems to  
43 exchange information with their local suppliers [85], so  
44 they might have alternative ways to communicate with each  
45 other, such as carrying out information exchange on an  
46 informal relationship basis rather than through formal  
47 systems [86]. As GP is a monitoring practice that is highly  
48 information-driven, the greater social control might ensure  
49 the efficiency of information exchange in the activities of  
50 GP so as to enhance the financial performance. Moreover,  
51 contrary to our expectation, this study does not detect a  
52 significant moderating effect of social control on the  
53 relationship between GCC and financial performance. This  
54 surprising result indicates that the social control mechanism  
55 might not be a necessary motivator of GCC to bring greater

56 financial performance. The insignificant moderating effect  
57 of social control highlights the fundamental role of GCC in  
58 achieving better economic performance, which is consistent  
59 with the finding of Larri et al. [26]. It seems that the  
60 motivating effect of social control on the GSCM-financial  
61 performance relationship is not supported. However, this  
62 study argues that such an unexpected result needs to be  
63 further investigated from the perspective of CT.

64 In order to get a deeper understanding of the joint effect  
65 of social control and GSCM, this study also examines a  
66 contextual factor, namely, environmental dynamism. As  
67 expected, the significant results of the three-way interaction  
68 show that the positive moderating effect of social control on  
69 the relationship between GSCM (including both GP and  
70 GCC) and financial performance is strengthened when the  
71 environmental dynamism is high. According to Yeung et al.  
72 [87], the fundamental need of any company in a dynamic  
73 manufacturing environment is to "*apply an effective*  
74 *process assurance system and to be proactive in taking the*  
75 *initiative to make improvements.*" This study suggests that  
76 the success of GSCM in the dynamic environment requires  
77 social control to improve financial performance. On the  
78 other hand, based on the simple slope analysis, this study  
79 finds that the moderating effects of social control in the  
80 GSCM-performance relationship are insignificant in a  
81 stable environment (i.e. low level of environmental  
82 dynamism). This result provides a fascinating perspective  
83 for understanding the role of social control in GSCM.  
84 Regarding GCC, the result implies that in a stable  
85 environment (i.e. low level of environmental dynamism),  
86 applying social control might not be efficient to promote  
87 financial performance. A possible explanation is that using  
88 social control to cooperate with business partners could be  
89 costly in a stable environment. Such a conclusion partially  
90 supports Zhu et al. [15], who find an inconclusive  
91 moderating effect of customer relational governance on the  
92 relationship between GSCM and economic performance. In  
93 addition, to avoid financial loss, the result demonstrates the  
94 necessity of using social control in monitoring the  
95 supplier's green activities. As shown in Figure 2,  
96 surprisingly this study finds a negative association between  
97 GP and financial performance in a dynamic environment  
98 when a company invests less effort in social control. A  
99 possible explanation is that if the buyer lacks social control  
100 over their suppliers, the highly unstable environment may  
101 encourage the suppliers' opportunism in green activities,  
102 such as by fraudulently reporting the "carbon emission  
103 level" or even deliberately hiding the information regarding  
104 pollutant discharge. It is not difficult to imagine that if there  
105 is no trust-based relationship between buyer and supplier in  
106 an uncertain environment, the supplier might engage in  
107 more opportunistic behavior to pursue their own benefit,  
108 resulting in a negative impact on the buyer's financial  
109 performance.

110

### 1 A. Contribution to the Literature

2 This study makes several contributions to the literature  
3 on GSCM and designing a sustainable and resilient supply  
4 chain. First, prior studies mainly assess the association  
5 between the GSCM and environmental performance [88].  
6 However, only a handful of studies provide evidence that  
7 integrating environmental concerns in supply chain  
8 management could bring the company better financial  
9 performance [4]. This study contributes to the GSCM  
10 literature by further examining the relationship between  
11 GSCM and financial performance. Specifically, our  
12 significant evidence adds to the generalizability of the  
13 GSCM-performance studies.

14 Second, by identifying the interactive effect between  
15 social control and GSCM practices, the research findings  
16 contribute to the existing GSCM literature from the  
17 perspective of SET. Although the supply chain  
18 management literature has widely recognized the  
19 importance of informal relationships, such as trust and  
20 cooperation [5, 6], very few studies or theories have  
21 attempted to explain this in the field of GSCM [15]. In line  
22 with the SET, this study adds to the GSCM literature by  
23 investigating social control as a moderator in the  
24 relationship between GSCM and performance. While recent  
25 studies have highlighted the roles of informal relationship  
26 and trust in facilitating the green supply chain management  
27 to improve firm performance [15], this study finds mixed  
28 results for the moderating effect of social control.  
29 Specifically, this study finds a significant joint effect on  
30 financial performance only in the case of social control and  
31 GP.

32 Third, by investigating the contextual factor of  
33 environmental dynamism, this research responds to the call  
34 of Sousa and Voss [9] for more sophisticated theorizing and  
35 tests in the area of OM. Also, in the environmental  
36 management context, to the best of our knowledge, there is  
37 no research examining the interrelationship among  
38 uncertainty, GSCM, social control and firm performance.  
39 Drawing from the CT, Chan et al. [4] find that under a high  
40 level of environmental dynamism, the effect of green  
41 innovation on a company's financial performance would be  
42 strengthened. This study provides further support and  
43 extends the research of Chan et al. [4] by examining the  
44 joint effects of GSCM and social control in a contingency  
45 paradigm. Furthermore, our significant three-way  
46 interaction results also offer a possible answer to the  
47 question raised by Sarkis et al. [2], regarding "*How to*  
48 *reduce the uncertainty that arises from implementing the*  
49 *GSCM activities and guide system function.*" This study  
50 suggests that social control could be an effective  
51 governance to facilitate the implementation of GSCM under  
52 a highly uncertain environment.

53 Fourth, this study also responds the call for integrating  
54 sustainability with supply chain resilience, which  
55 characterized by "*business continuity*" [89]. This study  
56 argues that to ensure the design of sustainable supply chain

57 remain unaffected or minimally affected in an environment  
58 that characterized by frequently avoidable disruptions, it is  
59 necessary for the firms to embrace social control. By  
60 integrating the effective governance mechanism like social  
61 control in planning the sustainable supply chain, the result  
62 of our three-way interaction analysis provides empirical  
63 evidence that not only could firms ensure the business  
64 continuity when environmental dynamism is high, but firms  
65 could even take the advantages of highly dynamic  
66 environment to improve their performance.

67

### 68 B. Managerial Implications

69 The present study also offers several suggestions for  
70 practitioners based on the research findings. First, although  
71 all GSCM can be effective in achieving high financial  
72 performance, practitioners should understand the  
73 characteristics of each practice. In order to avoid potential  
74 penalties from the government, managers should prioritize  
75 the implementation of GP. On the other hand, to enhance  
76 the company's green image or win more business  
77 opportunities in the market, investing in GCC might bring  
78 more significant and direct financial returns. Second,  
79 managers should realize that the integrative use of GSCM  
80 practices and social control could be an available option in  
81 the context of China. Given that informal relationships and  
82 trust play an important role in Chinese business [90],  
83 practitioners may enjoy more benefits by exerting social  
84 control over their chain members when implementing green  
85 practices. The success of GSCM relies heavily on shared  
86 vision, frequent information exchange and inter-  
87 organizational coordination [2]. Therefore, social control  
88 could be an optimal governance mechanism when  
89 implementing GSCM.

90 Last but not least, managers should understand how to  
91 adopt social control effectively in the implementation of  
92 GSCM under the contextual factor of a dynamic  
93 environment, which is characterized by frequent and rapid  
94 changes induced by technology, government policy,  
95 customers, and suppliers. Literature suggests that in order  
96 to reflect the real world situation, managers and researchers  
97 should extend their research model by including these  
98 contextual factors, since a bivariate or even trivariate  
99 relationship may not be comprehensive [9]. This study  
100 offers practitioners a more in-depth statement to explain the  
101 GSCM-performance relationship. It suggests that when a  
102 company's external environment is dynamic, it is necessary  
103 for the managers to apply social control with both GSCM  
104 practices, i.e. GP and GCC, to promote their financial  
105 performance. On one hand, this study recommends that  
106 managers should take advantage of the positive aspect of a  
107 dynamic environment. However, the effectiveness of social  
108 control in GSCM might be contingent on external  
109 circumstances. Practitioners should realize that the  
110 combination of GSCM and social control might not be  
111 efficient under a stable environment (as shown in Figure 2  
112 and Figure 3). If managers cannot correctly assess their

1 external environment, they might not get the expected  
 2 return from investing in such a combination. In this case,  
 3 our items that measure the environmental dynamism could  
 4 assist managers to evaluate their external environment.  
 5

## 6 VI. CONCLUSION

7 The purpose of this study is to verify the joint effect of  
 8 social control and GSCM on firms' financial performance,  
 9 especially in a highly dynamic environment, in the specific  
 10 context of China. From the perspective of CT and SET, this  
 11 paper develops a research model and empirically verifies  
 12 the complex inter-relationship among GP, GCC,  
 13 environmental dynamism and financial performance. This  
 14 study contributes to a major topic in the GSCM literature,  
 15 that of how GSCM impacts on the firm's financial  
 16 performance. This study finds that GP and GCC have  
 17 positive effect on financial performance. Drawing from the  
 18 SET, this study investigates the joint effect of GSCM and  
 19 social control on financial performance. In particular, we  
 20 find that social control positively moderates the effect of  
 21 GCC. Also, this study explains how and why the impact of  
 22 the GSCM-social control combination on financial  
 23 performance can be strengthened in a dynamic environment.  
 24 We suggest that social control could be a significant  
 25 motivator of GSCM to promote financial performance,  
 26 especially in a dynamic environment.

27 Although this study offers some important contributions,  
 28 the research findings and implications should be considered  
 29 in the light of several limitations. First, we need to clarify  
 30 that although social control is a governance mechanism that  
 31 primarily relies on the informal means, it is not same with  
 32 the concept of Guanxi, which is which is a unique people  
 33 based connection aspect in Chinese business [91]. Second,  
 34 similar to other relevant studies in GSCM [22], this paper is  
 35 limited by a relatively small sample size. Although the  
 36 power analysis indicates that our sample has sufficient  
 37 statistical power to explain the regression model, the future

38 research is recommended to verify our model in a larger  
 39 sample. A third limitation is that when empirically testing  
 40 the causality, this study investigates only the cross-sectional  
 41 data. Future research could conduct a longitudinal study to  
 42 investigate the dynamic relationships among the concepts  
 43 studied in this paper. Moreover, in our paper, we have  
 44 addressed endogeneity by the augmented regression  
 45 approach. However, given growing consideration on  
 46 endogeneity in survey study, we suggest future research  
 47 could also adopt other advanced approach, for example, the  
 48 matched control groups method [92, 93]. Forth, as this  
 49 research investigates only the Chinese manufacturing  
 50 industry, the generalizability of the results is another  
 51 limitation. Future research could resolve this issue by  
 52 examining our model in different regions to improve the  
 53 generalizability. Fifth, this research consider only social  
 54 control as a motivator of GSCM. As an alternative to social  
 55 control, formal control that emphasizes the contractual  
 56 system could also be a significant governance mechanism  
 57 in GSCM. Therefore, future research may benefit from  
 58 exploring the moderating roles of different governance  
 59 systems in the relationship between GSCM and firm  
 60 performance. Sixth, the selection of the variables that  
 61 deviated from SET and CT is incomprehensive. Many other  
 62 elements of SET can be considered in the future research,  
 63 such as reciprocity, solidarity, trust, power and commitment,  
 64 *etc.* [94, 95]. Moreover, to more precisely measure the  
 65 dynamic environment, we suggest the future research can  
 66 take multiple constructs (such as supply and demand  
 67 uncertainty, competitive intensity and technological  
 68 turbulence) into account [96, 97]. Finally, the adoption of a  
 69 subjective scale to measure firm's FP, due to issues  
 70 regarding data availability, represents a possible limitation  
 71 of this study. Although the scales used to measure FP in  
 72 this study have been widely adopted in previous literature,  
 73 future researches should address this concern by adopting  
 74 objective data (i.e. audited and published financial data), or  
 75 by using a multi-informant approach to improve the validity.

## APPENDIX A

The respondents were asked to indicate the extent to which they agree or disagree with the below statements as applicable to their firm: (1 = strongly disagree – 7 = strongly agree)

		Loading	Reliability and Validity
Green Purchasing			
GP1	We strive to prevent first-tier suppliers from transferring responsibility for environmentally sensitive operations to unqualified companies.	0.759	AVE=0.612 $\alpha$ =0.855  CITC range: 0.573-0.686
GP2	We regularly conduct environmental audit for suppliers' internal management.	0.704	
GP3	We evaluate the environmentally-friendly practice of second-tier suppliers.	0.804	
GP4	We have close cooperation with our suppliers regarding the environmental objectives.	0.855	
Green Customer Cooperation			
GCC1	We have cooperation with customers to maximize the use of logistics resources (e.g. good planning in product transportation route plan).	0.759	AVE=0.554 $\alpha$ =0.826  CITC range: 0.508-0.615
GCC2	We have close cooperation with customers to achieve cleaner production.	0.829	
GCC3	We have close cooperation with customers to develop environmentally-friendly packaging.	0.656	
GCC4	We have close cooperation with customers for eco design.	0.722	
Environmental Dynamism			
ED1	Prices for the product of our industry are volatile.	0.969	AVE=0.723 $\alpha$ =0.866  CITC range: 0.442-0.797
ED2	A high rate of innovation.	0.821	
ED3	Frequent and major changes in government regulations.	0.769	
ED4	The market for our product is dynamic.	0.830	
Social Control			
SC1	We rely on our partners to keep their promises.	0.780	AVE=0.566 $\alpha$ =0.831  CITC range: 0.523-0.590
SC2	Our partners are always frank and truthful in their dealings with us.	0.708	
SC3	Without monitoring, the partners would fulfil their obligations.	0.797	
SC4	We have fine-grained information exchange with our supply chain members.	0.720	

The respondents were asked to indicate the level of changes in their firm over the past three years (1= decreased significantly; 4= no change; 7= increased significantly)

		Loading	Reliability and Validity
<b>Financial Performance</b>			
FP1	Return on asset	0.652	AVE=0.538 $\alpha$ =0.855  CITC range: 0.453-0.595
FP2	Growth of sales	0.752	
FP3	Return on investment	0.773	
FP4	Growth in return on investment	0.754	
FP5	Profit margin on sales	0.730	

APPENDIX B. Marker-Variable Method

Variable	1	2	3	4	5
1 Green Purchasing		0.592**	0.197**	0.306**	0.100
2 Green Customer Cooperation	0.602**		0.336**	0.325**	0.148*
3 Social Control	0.216**	0.352**		0.574**	0.095
4 Financial Performance	0.323**	0.341**	0.584**		0.067
5 Environmental Dynamism	0.122	0.168*	0.117	0.089	
6 MARKER Variable	-0.072	-0.064	-0.016	0.024	0.068

The uncorrected correlations are below the diagonal; the adjusted correlations are above the diagonal.

Notes:

\*\*  $p < 0.01$

\*  $p < 0.05$



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